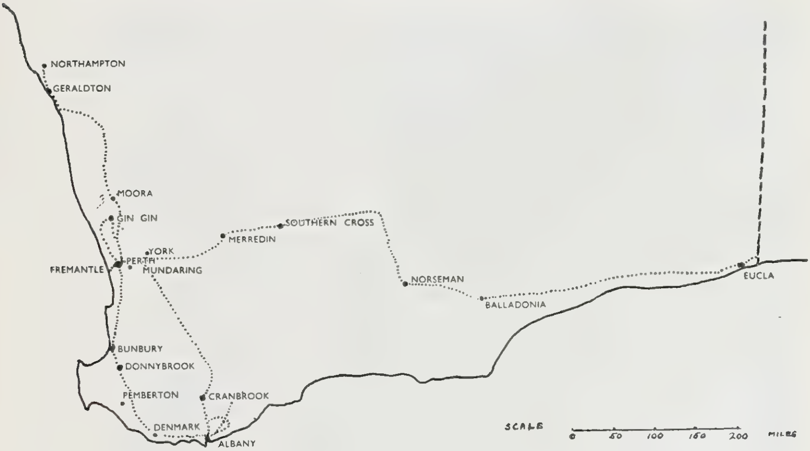
SOME IMPRESSIONS OF A SOUTH AFRICAN BOTANIST IN TEMPERATE WESTERN AUSTRALIA

By Margaret R. Levyns.

(With Plates XV and XVI.)

A botanist familiar with the Cape Flora in South Africa cannot fail to be interested in the unique but comparable flora of Western Australia. There families such as Proteaceae, Restionaceae, Thymelaeaceae and Rutaceae, uncommon or missing from most parts of the world, constitute important elements of the flora just as they do in South Africa. However, the abundance of other families such as Myrtaceae, Goodeniaceae, Pittosporaceae, Dilleniaceae, Tremandraceae etc., rare or absent in South Africa, makes it clear that the relationship is remote.

During the spring and early summer months of 1959, the writer, who has lived most of her life in contact with the Cape Flora in South Africa, had an opportunity of seeing the West Australian counterpart. Headquarters were made at Perth and journeys north, south and east were made so as to gain a general impression of the vegetation at once so similar to and yet very different from the South African. The routes followed are shown on the accompanying map.



Map.

Southern part of Western Australia.

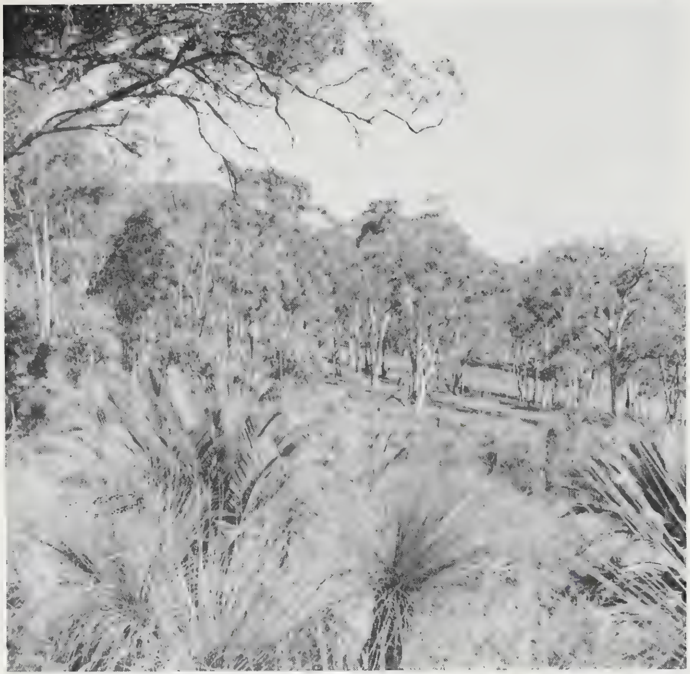
The main routes travelled are shown as dotted lines.

The climate of the south western corner of Australia is similar to that of the south western Cape Province. The rain falls mainly during the winter months and the summer is dry and hot. In the accompanying table the rainfall figures for selected localities are given. These are adapted from the tables given in Gardner's account of the vegetation of Western Australia[1]. It will be noticed that among the stations given the one with the highest rainfall is Pemberton, in the heart of the Karri forest in the south western corner. The annual rainfall diminishes both northwards and eastwards from this region. In the south the rainfall is more evenly distributed throughout the year though in every case more rain falls during the winter than in the summer. High ground is conspicuously lacking in Western Australia but wherever a moderate elevation exists, it has a marked effect on the rainfall. A comparison of the figures given in the table between those of Perth on the coastal plain and those of Mundaring in the Darling Range less than twenty miles distant, brings this out clearly. The Darling Range has an altitude with an average of about a thousand feet, yet its valleys are capable of supplying reservoirs with water not only for Perth but also for the towns on the goldfields over three hundred miles away.

	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Northampton(60)	·23	·42	·45	·79	2·61	4·53	4·15	3·24	1·84	·97	·35	·22	19·09
Perth (66)	·33	·40	·81	1·71	5·05	7·09	6·72	5·71	3·36	2·19	·76	·54	34·67
Mundaring (36)	·36	·67	1·01	2·04	5·74	8·18	8·95	7·19	4·73	3·07	·93	·65	43·52
Donnybrook (41)	·45	·63	1·11	1·76	5·69	7·68	7·76	6·08	4·63	2·98	1·16	·61	40·54
Pemberton (6)	1·60	·57	1·77	2·95	6·99	7·87	8·10	8·88	4·93	4·22	2·19	1·05	51·11
Denmark (40)	1·26	1·35	2·17	3·23	5·70	6·73	7·28	6·46	5·04	4·29	1·81	1·40	46·72
Albany (65)	1·01	·88	1·59	2·75	5·02	5·43	5·59	5·30	4·08	3·24	1·46	1·15	37·50
Merredin (38)	·40	·46	·92	·94	1·54	2·03	2·13	1·56	1·04	·89	·44	·57	12·92
Norseman (45)	·55	·71	·89	·96	1·17	1·14	·96	1·11	·72	·92	·82	·72	10·67
Balladonia (51)	·48	·51	·99	·70	·99	·93	·72	·91	·68	·97	·76	·67	9·31

Rainfall figures in inches. The number of years during which records have been kept, is given in brackets after each place name.

Though the rainfall is comparable with that of the western Cape Province, the topography of Western Australia is strikingly different. A visitor arriving in Perth from Fremantle will see what appears to be a range of low hills in the distance. Known as the Darling Range, this is not a true mountain but an escarpment and is the present western border of the old land of Yilgarnia, a land which has existed almost since the dawn of geological time[3]. At one time Yilgarnia must have had lofty mountain ranges with glaciers or rivers flowing in the valleys, but



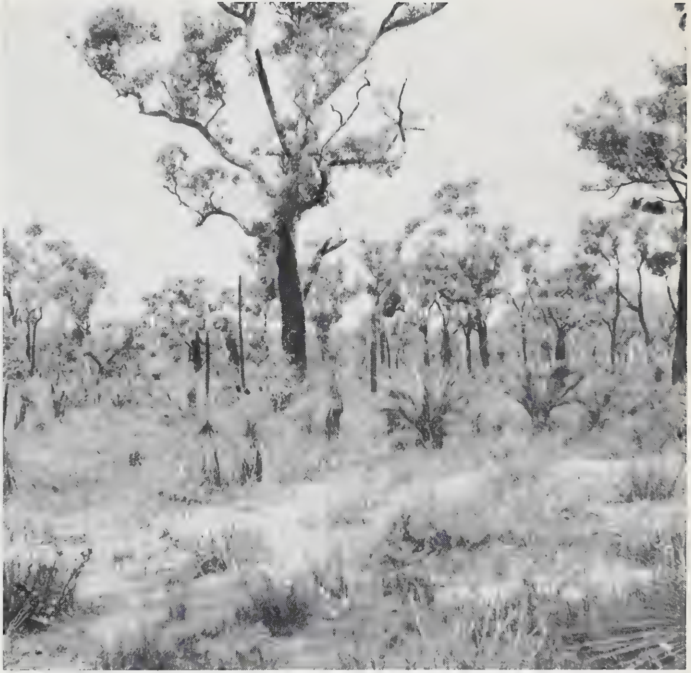


Plate XV.

Fig. 1.—Typical woodland scene in the National Park in the Darling Range near Perth. The trees are species of Eucalyptus. Blackboys and Cycads are in the foreground.

Fig. 2.—A more open type of woodland than that shown in photograph 1, on the Geraldton road about twenty miles north of Perth. Some of the Blackboys have young inflorescences. The small shrubs in flower belong mostly to the genus Hibbertia.

erosion in the course of ages, has worn away the mountains till today a flat landscape, with here and there a few low undulations, is all that is left. Not even rivers remain though it is generally assumed that the numerous salt lakes, dry except after very heavy rains, are relics of old river systems. No volcanic activity has disturbed its ancient peace though in the southern and eastern parts of Australia volcanicity has played its part until relatively recent times.

From the Darling Range to the Nullarbor Plain in the east the surface of the old land of Yilgarnia slopes down gradually till finally its granites and gneisses disappear below the limestones that cover much of the Nullarbor Plain. To the west of the Darling Range is a somewhat narrow coastal plain composed of much younger rocks. In the south the Darling Range peters out and the old land surface slopes down towards the sea which during the Tertiary epoch invaded this part of the area. The only mountains worthy of the name in the southern part of Western Australia occur a little north of Albany and are known as the Stirling Range. It extends from west to east for about forty miles and for most of the distance is considerably lower than Table Mountain though its highest peak, Bluff Knoll, is about one hundred feet higher. This and the much lower Porongorup Range to the south, are isolated mountains and there is nothing in Western Australia comparable with the continuous mountain chains of southern Africa.

Mountains introduce a range of climates into quite a small area. Sheltered valleys permit the continued development of mesophytic plant communities which would have no hope of survival in flat unbroken country with a mediterranean type of climate such as both South Africa and Australia possess. The mountain ranges of southern Africa antedate the period during which the Angiosperms evolved and it is evident that the mountains must be significant in the history of the floras now covering the land. Western Australia is wholly lacking in mountains which might in the past have provided sanctuary for older floras which once occupied the land. The striking uniformity in its vegetation is almost certainly correlated with the absence of mountains.

A visitor arriving at Perth in the spring is immediately overwhelmed by the variety of plants in flower. The introduction to the flora is made easy by the presence of a nature reserve, King's Park, just on the outskirts of the business part of the city. Here the natural vegetation is preserved and it says much for the civic pride of the inhabitants of Perth that even a striking plant such as the Kangaroo Paw (*Anigozanthos manglesii*) is allowed to grow unmolested along the public roads and paths within the park.

The task of getting to know the flora is simplified by a most useful handbook to the flora[2] where the excellent coloured plates give the botanist as well as the layman much needed help. King's Park may be taken as a typical example of the vegetation of Western Australia in parts with a moderate rainfall. At first sight the vegetation appears completely different from that of South Africa. In open country in the region of winter rainfall in South Africa, trees are a rarity. Such things as the Silver Tree near Cape Town and the Clanwilliam Cedar further north are exceptional and low bush is the rule. It would be difficult to think of any place outside forests in South Africa where one could get lost because of an inability to see far ahead. This is not so in Australia where the tree form is common and distant views are rarely possible unless the trees have been felled or burnt. Getting lost in the Australian bush is by no means a figment of the imagination. It is a real danger once one gets away from the towns.

Nowhere in Australia except in the driest parts and in moist tropical forest can one ignore the ubiquitous genus Eucalyptus. Throughout most of the continent it dominates the landscape, either in the tree form as in King's Park or in the shrubby mallee form in the drier parts. The term mallee is one in common use in Australia and denotes a growth form in which a number of equivalent stems arise from the underground parts instead of the solitary main stem as in a tree. There is no sharp boundary between the two growth forms but in general, mallee is a useful term for the plant ecologist. One of the most vivid impressions of the Australian scene is the amazing diversity in form and behaviour of the family Myrtaceae. Eucalyptus is the largest genus, with Melaleuca (Tea trees) coming second. In addition there are thirty-one other genera in Western Australia, many of them common. In size they range from forest giants to small undershrubs. Many have brilliantly coloured flowers, blue being the only colour not represented. Botanists used to seeing members of the Myrtaceae in cultivation in other lands assume that the family is easily recognised. In Western Australia they are soon disillusioned for *Actinodium cunninghamii* has the appearance of a member of Compositae while *Darwinia vestita* looks so much like a species of Agathosma that it was assumed by the writer that it belonged to Rutaceae until close examination proved otherwise. In the Cape Flora the family Myrtaceae is represented by one species only, *Metrosideros angustifolia*, a streamside plant. The genus does not occur in Western Australia and is best developed in New Zealand and the Pacific Islands. It is apparent that an outstanding difference between the floras of Western Australia and the south western Cape Province is the dominance of this particular family in the one and its extreme paucity in the other. The impression of dissimilarity of the two floras is heightened by some conspicuous common plants such as the Blackboy (*Xanthorrhoea preissii*) and a Cycad (*Macrozamia reidlei*). Several species of Casuarina play their part in making the flora look so unlike that of any other part of the world. If the Eucalypts and these other unusual plants be banished from one's mind, then the undergrowth is not unlike the Cape sclerophyll though the plants comprising it are mainly different. Many of the families are familiar. The family Leguminosae is well represented and the brilliant colour of its flowers is one of the striking features of an Australian Spring. A link between South Africa and Australia is the Tribe Podalyrieae, best developed in Australia which has about thirty genera. In South Africa there are two common genera, Podalyria and Cyclopia. In the sub-family Mimosoideae the numerous species of Acacia are prominent in the Australian scene. In South Africa only one native species, *Acacia karroo*, reaches the region of the Cape Flora though the genus is common in other parts of Africa. It is more likely that *Acacia karroo* is an invader into the Cape area than an integral part of the Cape Flora. Several species of Acacia which have been introduced into the Cape region from Australia have established themselves so firmly that in places the Australian element dominates the scene. The problem raised by foreign invaders in both countries will be discussed later for in Australia some South African plants behave in much the same way as Australian plants in South Africa.

The family Proteaceae occupies a similar position in both countries, the plants being both conspicuous and colourful. The flowers show a much wider range of structure in Australia and some genera such as Conospermum and Stirlingia do not at first sight suggest Proteaceae to a South African botanist. A difference which brings itself home forcibly to the field botanist in Australia is the spiny nature of the leaves in so many of the species. In South Africa though the leaves are leathery they are never spiny and one can push one's way without laceration through any type of native proteaceous scrub. The tendency to spininess in West Australian plants appears not only in the Proteaceae but in other families as well and is one of the striking differences between the two floras. In Australia one would never approach species of Hakea, Grevillea, Acacia or Daviesia, to mention just a few genera, without ascertaining whether or not it is safe to do so.

Two families well represented in both countries are Thymelaeaceae and Rutaceae. Pimelea, belonging to the former family, has many species and bears a superficial resemblance to the South African genus Gnidia. Among the Rutaceae the resemblance is not usually very striking for in Australia the genera belong to the tribe Boronieae while the African genera belong to the Diosmeae. Nevertheless *Crowea dentata* has much the appearance of *Agathosma betulina*, the buchu of commerce.

The small family Byblidaceae is confined to the two countries, Byblis in Australia and Roridula in South Africa.

The austral family Restionaceae affords another link though in this case the family is much better developed in South Africa. In Australia there are relatively few species and only in rare instances do they dominate the scene. In South Africa the species are numerous, a recent estimate giving a total of 282 species of which 109 belong to the genus Restio. In many cases the species grow socially and form a conspicuous part of the vegetation. It would be impossible for even an indifferent observer to overlook the family in South Africa whereas this could be done easily in Australia.

Compositae is another family which is much more abundantly developed in South Africa. The shrubby members which occur in large numbers in the Cape area, are rare in Australia where herbaceous forms abound. The genera Helichrysum and Helipterum which are common to both countries, show this difference of habit clearly.

In addition to the genera already mentioned there are several others, not of world wide occurrence, which appear in both floras. The following list will serve to illustrate these generic links:— Chrysithrix, Tetraria, Wurmbea, Bulbine, Caesia, Dodonaea, Carpobrotus, Pelargonium, Zygophyllum, Cassytha, Wahlenbergia.

Though the similarities in floral relationships between the two countries are striking, the dissimilarities are equally so. The family Myrtaceae, the hall mark of the Australian scene, has been mentioned. Other characteristic families which are absent or almost so from South Africa are:— Casuarinaceae, Goodeniaceae, Stylidiaceae, Pittosporaceae, Stackhousiaceae, Epacridaceae, Tremandraceae, Dilleniaceae and Cephalotaceae. The Goodeniaceae with their often brilliantly coloured blue, red or yellow flowers, are among the most spectacular of the spring flowering plants. A memorable sight is a roadside bordered with a blue ribbon of *Leschenaultia biloba* and species of Dampiera. The predominance of blue flowers, a remarkable feature of the flora of Western Australia, is well brought out by this family. The only member of Goodeniaceae in South Africa is the rather drab *Scaevola thunbergii* which is common on the sea shore from Mossel Bay eastwards. The genus Hibbertia, belonging to Dilleniaceae, of which South Africa has no representative, is extremely common in the less arid parts of the south west. The yellow flowers of this genus are usually to be seen forming part of the colourful carpet between the Eucalyptus trees. The family Epacridaceae is closely related to the more widely spread Ericaceae, conspicuous in the South African flora. Though the Epacridaceae are frequently called heaths in Australia, they seldom have the aspect of a true heath. Apart from the genus Leucopogon which is widespread and common, they are rather local in their distribution and only assume importance in the south, in places with a high rainfall. Round about Albany members of the family are abundant.

There are two endemic families only in Western Australia, Tremandraceae and Cephalotaceae. Both families are small and together contain about fifteen species. In South Africa there are four such families, Penaeaceae, Geissolomataceae, Bruniaceae and Grubbiaceae. The number of species belonging to these families is about one hundred. Endemic families play a more important part in the Cape Flora than they do in that of Western Australia.

A considerable number of aliens are established in Western Australia and plants from South Africa form a considerable proportion of them. How and when these South African immigrants arrived is not clear but some have obviously been in Australia for a considerable period and are completely established. For example the coastal sands north and south of Fremantle have so many Cape plants that at times it was difficult to remember that one was not in South Africa. *Carpobrotus edulis* is common and is known in Australia as Pig-face. *Anthericum divaricatum* is locally abundant. Others frequently encountered are *Pelargonium capitatum*, *Tetragonia decumbens* and *Heliophila pusilla.* In Perth there is a legend that the seeds of these coastal plants reached Australia in sand brought from Table Bay as ballast in vessels trading between the two countries. The traffic must have been in one direction only for South Africa has none of these accidental introductions. The Australian plants in South Africa were introduced deliberately by man. Further inland other South African plants are encountered. One of the most widely distributed of these is *Arctotheca calendula*, known in Australia as the Cape Weed. This species has spread all over Temperate Australia but exhibits its greatest vigour in Western Australia. In land cleared for farming it often takes possession and provides attractive splashes of colour during the spring. It has some food value for stock and for that reason is accepted as a welcome addition to the indigenous flora. This is far from being the case with *Homeria breyniana* which has also spread rapidly. Its aggressive habit and poisonous nature make it a most unwelcome intruder. It seems unlikely that this much disliked plant was in the first instance introduced as a garden plant for it is as unpopular in the land of its origin as it is in Australia, but many other members of Iridaceae appear to have started their migrations from gardens. Species of Watsonia, Gladiolus, Freesia, Babiana, Sparaxis and others probably gained an entry in this way but now are so firmly established that it is difficult to think of them as aliens. *Ehrharta calycina*, known in Australia as Veld Grass, has become somewhat aggressive in the neighbourhood of Perth. In South Africa though widespread it is rarely social in its behaviour and does not attain the size it does in Australia.

The following list of South African plants established in Western Australia was compiled during the author's stay of a little over six weeks. It makes no claim to be regarded as a comprehensive list of naturalised South African plants but it will give some idea of the large South African element which has made itself at home in Australia.

Gramineae	*Ehrharta calycina* Sm.
Iridaceae	*Babiana stricta* (Ait.) Ker.
	Ferraria undulata L.
	Freesia refracta Klatt
	Geissorhiza spp.
	Gladiolus caryophyllaceus Poir.
	Homeria breyniana (L.) Lewis
	Ixia maculata L.
	Ixia spp.
	Romulea rosea Eckl.
	Sparaxis grandiflora Ker.
	Watsonia pyramidata (Andr.) Stapf
	Watsonia spp.
Liliaceae	*Anthericum divaricatum*
Araceae	*Zantedeschia aethiopica* (L.) Spreng.
Cruciferae	*Heliophila pusilla* L.f.
Aizoaceae	*Carpobrotus edulis* (L.) N.E. Br.
	Tetragonia decumbens Mill.
Geraniaceae	*Pelargonium capitatum* (L.) Ait.
Solanaceae	*Solanum sodomaeum* L.
Compositae	*Arctotheca calendula* (L.) Levyns
	Arctotheca nivea (L.f.) Lewin
	Osteospermum clandestinum T. Norl.
	Ursinia anthemoides (L.) Gaertn.

In most cases the plants enumerated above are identical in their homeland and in the country of their adoption. In a few cases, however, there are slight changes. This has already been noted for *Ehrharta calycina* which in Australia grows more vigorously, is taller and has adopted a social habit. The same vigour was noted in *Gladiolus caryophyllaceus* which frequently attains a height of two feet. In its homeland this handsome species which is usually smaller, is fast disappearing due to cultivation of the veld and other activities of man. *Sparaxis grandiflora* which is variable in South Africa is represented in Australia by a rather small form. *Osteospermum clandestinum*, a common species in South Africa, usually has pale yellow ray florets whereas in Australia the rays have a reddish tinge. *Arctotheca nivea* which is a handsome sea shore plant in South Africa is common round about Albany in similar situations.

However, in the Australian form the ray florets are short and the flower heads are not showy.

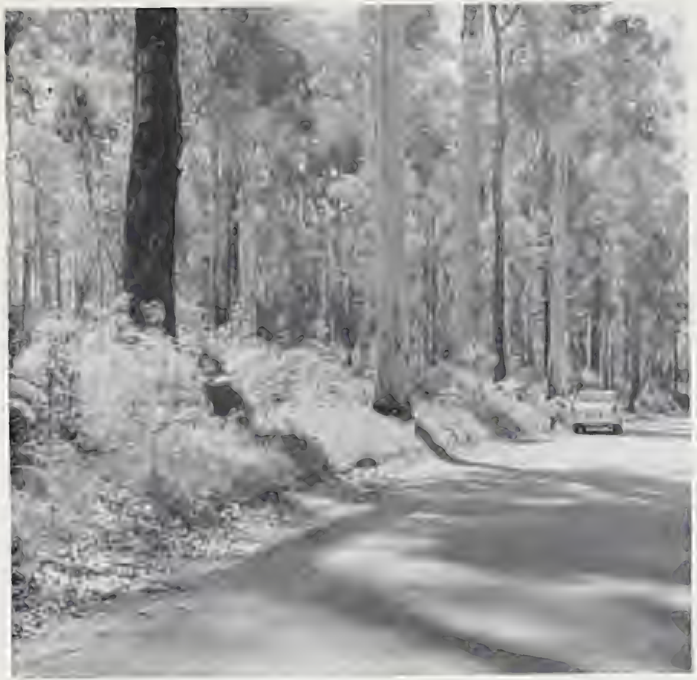
Gardner[1] on p. xxvii refers to alien weeds in Western Australia as having "in the main, proved quite ineffective as a permanent invading force when subjected to competition under natural conditions". In general the writer is able to confirm this statement though *Ehrharta calycina* and some of the Iridaceae appear to be capable of invading natural vegetation and inducing some modification of the undergrowth. However, all the South African intruders are small plants and it seems unlikely that they are capable of bringing about profound changes in a country where large trees and shrubs dominate the scene. The case in South Africa is very different for the invading plants are larger than the indigenous bush. For example several phyllode-bearing species of Acacia were introduced many years ago to assist in controlling drift sands on the Cape Flats near Cape Town. They did their work well but as a result the native plants of that region have been all but eliminated and the Australian victors have taken possession. Since that day the invaders have succeeded in spreading over various parts of the Cape Province and they defy efforts to restrain their exuberance. Several species of Hakea have behaved in a similar fashion but in this case they were probably imported as garden plants. Before long they escaped from cultivation and invaded the veld. To-day, despite the fact that the aggressive species have been proclaimed noxious weeds, they resist all too firmly attempts to eradicate them. The species of Acacia and Hakea, so aggressive in South Africa, behave as peaceful constituents of plant communities in Australia. Evidently in their homeland factors are at work which restrain these plants from behaving as they do in South Africa.

Strangely enough various species of Eucalyptus which grow well in South Africa, have not shown much tendency to spread from plantations and invade natural vegetation.

A feature of the vegetation of southern Western Australia that impresses a botanist from South Africa is its remarkable floristic uniformity. The genus Eucalyptus is omnipresent and it is mainly this genus that characterises the different plant associations. The species vary both with rainfall and with differences in the soil. In the drier parts the trees are smaller, are more widely separated and may assume the mallee form, whereas in the more favoured localities trees become taller until ultimately they form true forest. From Donnybrook southwards, on soil derived from laterite, there are Jarrah forests (*Eucalyptus marginata*). With a still higher rainfall and in areas where the soils are derived from granite or gneiss, the Karri (*Eucalyptus diversicolor*) forms impressive forests. The tall straight trees with their pale smooth bark are an unforgettable sight. So too is the rich and varied undergrowth of these forests. It is in fact a type of temperate rain forest. In South Africa where such forests exist, as at Knysna and in sheltered ravines, they are floristically entirely different from the Cape Flora of the open slopes and plains. The common genera in such forests are Podocarpus, Olea, Curtisia, Ocotea etc., genera which play no part at all in the composition of the Cape Flora. In South Africa these forests may be relics of an old flora which has been able to survive because of favourable refuges provided by sheltered mountain slopes and ravines. In Western Australia where mountain chains are wholly lacking, an old forest flora would have had little chance of survival during periods of unfavourable climate. It is probably significant that in Western Australia fossil pollen grains of the genus Nothofagus, the Southern Beech, have been discovered. To-day that interesting genus with its typically southern distribution, in cold temperate regions, does not occur in Western Australia though it is still to be found in Tasmania and in scattered places in the eastern states. However, the knowledge that it was once a widespread constituent of a post-Cretaceous Australian flora, provides food for thought. Possibly the curious shrubby species of Podocarpus (*P. drouyniana*) which occurs in the undergrowth of the denser forests in the south west is a survival of a flora most of which has disappeared.

The comparison which has been made between the vegetation of the two countries has dealt exclusively with a sclerophyllous type adapted to regions with winter rains and summer drought, regions where the average rainfall does not go below about ten inches a year. Where the rainfall is lower the differences between the two countries are accentuated. In South Africa where the Cape Flora lies adjacent to the Karoo, there is a sudden change from one type of vegetation to another once the critical rainfall figure is reached. The flora of the Karroo bears no floristic relationship to the Cape Flora and is composed largely of succulents. In Western Australia the change from one flora to another is gradual. The size of the trees of Eucalyptus and Acacia diminishes and the numbers also decrease. Finally trees disappear altogether and non-succulent salt-bush which in the drier parts is a constitutent of the plant life between the trees, covers the ground in a fairly close association. The density of the plant cover on the Nullarbor Plain where it is traversed by the Eyre Highway, came as a surprise to one used to the South African Karroo where, except in very sheltered kloofs, the succulent bushes are scattered with much bare earth visible between them.

In all places with a Mediterranean type of climate the aspect of the vegetation is similar but that does not necessarily mean that the taxono-



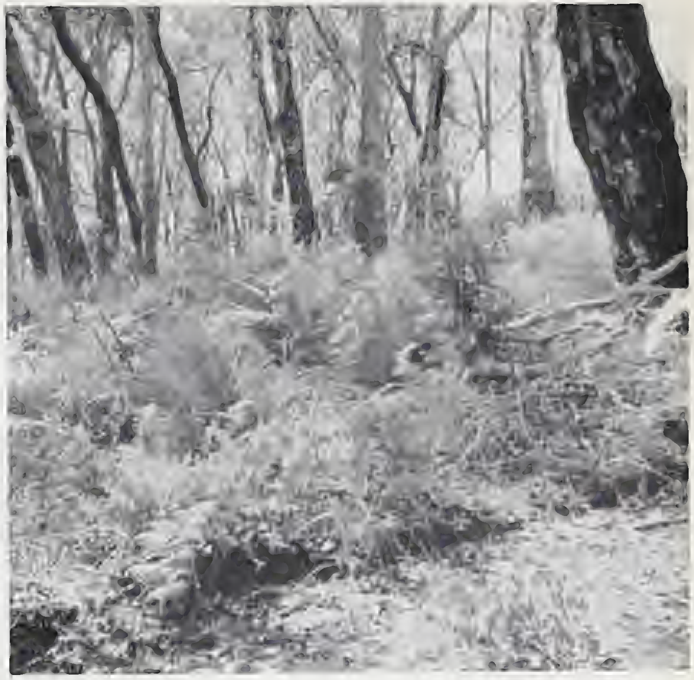


PLATE XVI.

FIG. 1.—In the Karri forest near Pemberton. The Karri trees (*Eucalyptus diversicolor*) may be recognised by their pale, smooth bark.

FIG. 2.—Scene in the Jarrah forest near Donnybrook. Dense undergrowth occurs under the trees.

mic elements comprising the floras show affinities. For example in Provence in the south of France the general appearance of the vegetation is much like that of the Cape region in South Africa, but the elements which make it up are entirely different. The Cape region and Provence and the Cape region and Western Australia are widely separated geographically, yet in the first case there is no floral affinity and in the second the affinity is pronounced if remote. The taxonomic relationship between the floras of South Africa and Western Australia suggest that in the past both countries derived some of their floral elements from a common source. Botanists are by no means agreed as to the whereabouts of that common source. Some place it near Antarctica while others urge that a northern origin is more in accordance with the facts of present day plant distribution. The trouble with all the theories of plant migrations in the Southern Hemisphere is that they are based on inadequate evidence. New hope of settling some of these problems comes from the young and flourishing science of palynology. Hitherto many of South Africa's Cretaceous and post-Cretaceous plant fossils have proved to be too fragmentary to be of great value. Now that it is known that plants may be recognised with a considerable degree of certainty from their fossilised pollen grains there is new hope of obtaining information about the past floras of South Africa. The development of special methods for extracting pollen grains from a stony matrix has led to advances in our knowledge of past floras of the circumpolar regions of the south. In Western Australia work is in progress along these lines and it is hoped that before long South Africa will fall into line with the other lands of the Southern Hemisphere and add her contribution to the ever-unfolding story of the past. Perhaps the hope expressed by the late Field Marshal Smuts in his Presidential Address to the South African Association for the Advancement of Science in 1925 that palaeobotany would succeed in solving the mystery of the origins and movements of the southern floras, will soon be on the way to realisation.

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